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Assessment of Safety for Construction Project- Case Study

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ABSTRACT
This study will try to put the safety management in construction project as one of the important elements to project performance and success. The data will be collected by doing the questionnaire and a case study. The analysis of the survey will be done by using the questionnaire filled at construction industry. Field Survey is done to study the predominant environment that involves safety management in the execution of various phases of a construction project. This survey is done to have the first hand information, essential to be aware of the safety problems encountered in the construction projects. The objective of doing a field survey in this study is to validate the findings of the literature review. The method that had been used for this research is by literature review and followed up by data collection using questionnaires. The questionnaires had been distributed to the project teams of 16 Units 7-Storey Residential apartment development consists of the client, consultant, contractor and companies and had received the feedbacks. The degree of importance was also been calculated for the current practices of safety management to know which current practice is adopted at which extent.

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I. INTRODUCTION

In developing India on becoming a developed nation by the year 2020, construction industry has been recognized as one of the major economic forces. Unfortunately, high rates of accidents and fatalities had tarnished its reputation and image. Globally, the construction industry is still considered as one of the most hazardous industries. Construction safety as a result continues to represent a problem and pose a challenge for researchers and practitioners. In India, both the society and economy have suffered human and financial losses as a result of the poor safety performance in the construction industry

The purpose of this study is to examine safety management in the Indian construction industry, as well as to highlight the importance of construction safety management. The industry has contributed significantly to the economic growth of the country. However, when construction safety management is not implemented systematically, accidents will happen and this can affect the economic growth of the country. This study will try to put the safety management in construction project as one of the important elements to projectperformance and success

Introduction of Recommended Practiced:

The recommended practices provide responsible employers, workers, and worker representatives1 with a sound, flexible framework for addressing safety and health issues on diverse construction job sites. They may be used by any

ConstructionCompany or job site, but they will be particularly helpful to small and medium-sized contractors. They also include guidance specifically aimed at general contractor employment, staffing agency employment, and multiemployer work situations. These recommended practices have been developed solely for the construction industry. Separate recommended practices are available for all other industries.

The recommended practices emphasize a proactive approach to managing occupational safety and health. Traditional approaches are often reactivethat is, actions are taken only after a worker is injured or becomes sick, a new standard or regulation is published, or an outside inspection finds a problem that must be fixed. Finding and fixing hazards before they cause injury or illness is a far more effective approach. Doing so avoids the direct and indirect costs of worker injuries and illnesses, and promotes a positive work environment.

These best practices present principles and approaches to implementing and maintaining a safety and health program for the entire construction company. OSHA recognizes that a wide variety of small and large construction job sites exist. Some are short-duration, while others may take years to complete; some sites are characterized by frequently changing conditions, while other sitesconditions may change less often. An effective program emphasizes top-level ownership, participation by employees, and findsfix approach to workplace hazardsIdentification‖ and ―Hazard Prevention and Control‖ core elements. Because of the wide variety of site conditions, these two core elements should be implemented on a site-specific basis in order to effectively detect and correct hazards.

The concept of continuous improvement is central to these recommended practices. As with any journey, the first step is often the most challenging. The idea is to begin with a basic program and grow from there. By initially focusing on achieving modest goals, monitoring performance, and evaluating outcomes, you can help your company progress over time along the path to higher levels of safety and health.

The Benefits of Implementing Recommended Practices: Responsible employers know that the main goal of a safety and health program is to prevent work-related injuries, illnesses, and deaths, as well as the suffering and financial hardship these events can cause for workers, their families, and their employers.

Employers may find that implementing these recommended practices brings other benefits as well. The renewed or enhanced commitment to safety and health and the cooperative atmosphere between employers and workers have been linked to:

- Improvements in production and quality.
- Better employee morale.
- Improved employee recruiting and retention.
- A more favourable image and reputation (among customers, suppliers, and the community)

How to Use the Recommended Practices: Each section of the recommended practices describes core program elements which are management leadership, worker participation, hazard identification and assessment, hazard prevention and control, education and training, program evaluation and improvement, communication and coordination for employers on multiemployer worksites, followed by several action items. Each action item is an example of steps that general contractors, subcontractors, managers, supervisors, and workers can take to establish, implement, maintain, and improve safety and health programs. a general self-evaluation tool can be found on the recommended practices web page. it can be tailored to your construction site to track your progress and document how you have implemented (or will implement) each action item.**Seven Interrelated Elements:** The seven core elements are interrelated and are best viewed as part of an integrated system. Actions taken under one core element can (and likely will) affect actions needed under one or more other elements. For example, workers must be trained in reporting procedures and hazard identification techniques in order to be effective participants. Thus, the Education and Training‖ core element supports the Worker Participation core element.

While the action items under each core element are specific, they are not prescriptive. The process described in these recommended practices can, and should, be tailored to the needs of each construction company and/or job site. Likewise, your safety and health program can and should evolve. Experimentation, evaluation, and program modification are all part of the process. You may also experience setbacks from time to time. What is important is that you learn from setbacks, remain committed to finding out what works best for you, and continue to try different approaches.

Scope of the project: This study is the first step in reducing the percentages of accidents in construction site. In addition, this study will lead the reader to know how far is the implementation of the Construction Safety Management in India is being done. Besides that, it also gives an overview about current situation in construction site. Thus, this will reduce the bad impression many people that construction site is a danger workplace. The employer must make a suitable and sufficient assessment of:

- The health and safety risks to employees whilst at work;
- The health and safety risks to which people not in his employment may be exposed due to the way in which any aspect of his business is conducted.

Objectives of the Project: The aim of this project is to assess the safety for construction project because various team members are work together in construction industry and accident risk is very high at construction projects.

The above study can have following five main objectives.

- To study the construction safety at projects.
- Assessment of safety for construction project.
- To involve the assessment of safety study on live construction projects.

- To analysis the data collected by questionnaire.
- To give the discussion and suggestion for effective safety program for construction projects.

II. LITERATURE SURVEY

A. CONSTRUCTION SAFETY MEANING FROM MANAGEMENT GURUS

'Safety First' is a very common scenery that we can see at most construction sites in our country. However, is safety really being put under first priority as stated on the poster? Thus, safety management highlight how important it is to ensure that the implementation and compliance of safety aspects at construction site are carried out with serious efforts by all the construction stakeholders involved so that it will not be merely a slogan only.

Although the accident rate in the construction industry of Hong Kong is argued to decline in recent years due to improved safety measures, it still remains higher than that of other developed countries (Choudhry et al., 2009).

Notably, many of these work-related deaths and injuries are preventable. As Williams (2000) advised, site safety should be enhanced since construction projects have become more complicated in recent times.

Construction sites are crowded with workers who undertake numerous high risk duties such as operating at height and outdoors and with heavy machinery and equipment (Tam et al., 2004).

Mitropoulos and Cupido (2009) also suggest that production practices can prevent production errors. Therefore, it is believed that safety practices can prevent human errors, thereby reducing the likelihood of accidents if these practices were shaped by the guiding principle and its associated strategies focusing on avoiding construction errors and rework.

B. FACTORS AFFECTING IMPROPER SAFETY MANAGEMENT

i. Organisation Safety Policy

The company expects employees to confirm to this policy and to comply with the relevant health and safety standards laid down by various statutory requirements. The employees are also expected to exercise all reasonable care for their own health and safety and that of others who may be affected by their acts or missions.

ii. Safety Meeting

The Project Manager, Quality officers and Quality engineers will lead safety patrols, safety co-ordination meetings and after work site clean up being a normal, not exceptional, daily routine. Also daily labour problems regarding facility are also solving regularly.

iii. Safety Training

Hinze and Wilson (1999) indicate that there is unanimous agreement among the respondents of their study that worker training is vital to improved safety performance.

iv. Availability of Safety Equipment

Toole (2002) argues that some construction accidents results because of the absence of safety equipment necessary to perform the job safety at the location of the work.

v. Safety Inspections

Safety inspections are the usual means used to enforce safety at the jobsite. Hinze and Gambatese (2003) indicate that safety inspections are one of the means by which project managers and site supervisors can become acquainted with the nature of the safety conditions on the site.

vi. Safety Incentive and Penalties

Hinze and Gambatese (2003) indicate that of the various types of safety initiatives that companies utilize to promote worker safety, the most widely implemented type of program involves safety incentives.

vii. Workers attitude towards Safety

Aksorn and Hadikusumo (2008) indicate that attitude is a tendency to respond positively or negatively to certain persons, objects or situations. Individuals are different in their perception of risks & willingness to risks. Successful safety programs can have achieved if the positive attitudes of employees towards safety are improved.

viii. Labour Turnover Rates

To improve safety performance, Harper and Kohen (1998) recommend reducing labour turnover rates. Hinze and Gambatese (2003) examine the relationship between labour turnover rates and safety record.

ix. Compliance with Safety Legislation

In order to improve safety performance, a standard checklist is used to conduct the audit. This checklist included those items which are compliance to Occupational Safety and Health Act and Factories and Machinery Act and perceived to be important from the safety point of view (Shuratman Z. et al., 2007).

C. COMMUNICATION & COORDINATION

An increasing number of workers are assigned by staffing agencies to work at specific host worksites under the direction and control of the host employer. It is important for the staffing agency and the host employer to communicate and coordinate to provide and maintain a safe work environment for their workers.

Inconsistent safety policies may also cause workers to question the credibility of safety and health programs, resulting in less meaningful

employee engagement and participation. Effective communication and coordination among such employers means that:

General contractors and their workers are aware of:

- The types of hazards that may arise from the work being done on site by workers employed by contractors, subcontractors, or staffing agencies.
- The procedures or measures needed to avoid or control exposure to these hazards.
- How to contact the contractor, subcontractor, or staffing agency if they have a safety concern?

Before coming on site, contractors, subcontractors, & staffing agencies and their workers are aware of

- The previous work done and the types of hazards that may already be present at the job site.
- The procedures or measures they need to use to avoid or control their exposure to these hazards.

III. CONSTRUCTION SAFETY AT PROJECT SITE

A. INTRODUCTION

A successful corporate safety programme should include a clear statement of policy by the client or owner, expressly showing management support for meeting safety objectives and the involvement of different stakeholders in the management system.

i) Clients

Clients should put safety and health on the top of the agenda along with financial considerations. To ensure that all contracts are completed on time, on budget and safely, clients should:

- Ensure that safety and health is not compromised
- Ensure best value as against the lowest cost
- Put in place safety and health considerations during the design stage
- Have allowed sufficient time and resources for implementing the contractor‘s safety program.

ii) Contractors

- Plan emergency routes and exits, traffic routes, danger areas, loading bays, ramps, etc.
- Ensure provision of safe work equipment, with due care to their suitability, selection, safety features, safe use, training and information, inspection and maintenance.
- Provide safe working slope for excavators.
- Design and anchor fork-lift trucks and dump trucks to prevent roll-over or overturn
- Provide suitable safety signs and warning notices
- Provide personal protective equipment, e.g. reflective clothing that should be fit, comfortable and well maintained.
- Keep the workplace free from hazards
- Provide suitable communication and information to let employees know how to protect themselves against hazards
- Conduct regular jobsite safety inspections
- Employ trained first aid personnel on site and/or put in place an emergency response system.

iii) Employees

- Follow all safety rules
- Ensure that all safety features and equipment installed are functioning properly
- Replace damaged or dull hand tools immediately
- Avoid horseplay or other activities that create a hazard
- Stop work when they are unwell or physically not fit to do the job
- Report any unsafe work practice and any injury or accident to the line supervisor

iv) Senior Site Management

- Inform workers of the risks present and the control measures required
- Establish emergency procedures
- Avoid all risks to workers
- Ensure that appropriate training is given

v) Architects, structural engineers, and other designers

- Discuss and agree the safety and health terms with client
- Plan for safety and health in layout and design drawings, with due regard to build ability, future maintenance and repairs
- Provide information about the safety and health risk of the design after the client has decided on which contractor(s) to use
- Carry out periodic checks and sort out interface problems with different contractors
- Certify contractor‘s claims for safety payment and conclude the final accounts.

vi) Safety professionals and supervisors

- Identify hazards in the workplace
- Give advice and suggest options for solving safety or health problems
- Suggest different kinds of help available, such as specialists in chemical, electrical and mechanical engineering safety to sort out issues at stake
- Investigate accidents/incidents and recommend remedial measures
- Carry out periodic checks and provide a written report summarizing the findings
- Develop and maintain an effective safety and health programme
- Provide safety training for employees

B. PRE-WORK PLANNING

Before starting any activity at site pre-work planning should be done. Short meeting should be taken in presence of execution team members & safety officers. All safety pre-work planning should be done and checklists of the different works are sanctioned by the project manager For small worksites or construction projects, look for the dangers on site (not as a substitute for a full risk assessment) and take the following preventive actions:

- Ensure that dangerous substances on site are being properly stored and used
- Provide and ensure that all persons on site wear proper personal protection equipment
- Identify ways that a risk can be controlled without using personal protective equipment (PPE)
- Ensure that workers are using the right and fit PPE for the job
- Check all plant, machinery and equipment (including PPE) are marked and correctly labeled, e.g. Safe Working Load
- Fence the site against unauthorized entry
- Take measures to prevent objects from falling from height and to take measures to protect members of the public (such as persons passing by the site)
- Provide and keep safe egress and access to the place of work, such as access to scaffolding
- Put up appropriate signs including traffic routes, authorized personnel only etc.
- Provide sufficient welfare and first aid facilities
- Provide adequate fire precautions such as fire extinguishers, escape routes
- Ensure that existing power lines (buried or overhead) are identified and associated safe systems of work in place
- Take necessary precautions to ensure that electrical systems are well maintained in a safe condition
- Ensure that vehicles and people are kept apart, especially slewing vehicles, with traffic routes maintained in a safe condition
- Ensure that vehicle and plant operators are suitably trained or licensed if required
- Ensure that hoists and lifting appliances are properly installed and checked by competent persons
- Ensure that scaffolds are erected, altered and dismantled by competent people only
- Take measures to stop workers from falling and ensure fall protection
- Minimize and eliminate risk of manual handling by the use of mechanical equipment, or arrange material to be supplied in manageable sizes and weights to reduce the risk of back injury
- Take all measures to reduce exposure to noise and vibration
- Ensure that holes are protected, with clear marking and fixed covers to prevent falls
- Ensure that excavations are adequately supported or otherwise constructed to minimize the risk of collapse and arrange regular inspection by a competent person.

IV. ASSESSMENT OF SAFETY FOR CONSTRUCTION PROJECT

The assessment of safety for construction project will be carried out through following procedure:

A. RESEARCH METHODOLOGY

Field Survey is done to study the predominant environment that involves safety management in the execution of various phases of a construction project. This survey is done to have the first hand information, essential to be aware of the safety problems encountered in the construction projects. The objective of doing a field survey in this study is to validate the findings of the literature review.

B. PROJECT ACTIVITIES

The method that had been used for this research is by literature review and followed up by data collection using questionnaires. The research starts first with literature review on the topic of safety management in construction project. The Exploratory survey had been conducted to identify and making sure the effectiveness of the questionnaire survey. The questionnaire survey commenced right after the questionnaire had been improvised according to the Exploratory survey. Site visit needed to gain actual data from the site. The data from the survey and site visit will then be analyzed to attain the useful information.

C. EXPLORATORY SURVEY AND DATA COLLECTION

Exploratory survey is a small scale methodological test intended to ensure that proposed methods and procedures will work in practice before being applied in a large and expensive investigation. It is a survey usually carried out prior to the main survey with the intent to gain information to improve the efficiency of the main survey. Exploratory survey provides an opportunity to make adjustments, revisions and to alert the surveyor to any difficulties that were not anticipated in the survey proposal stage for example, to ascertain the time taken to complete the questionnaire or to determine the most effective

size of the sampling unit. A Exploratory test will be administered to the same group of construction professionals to clarify and refine the questionnaire. By incorporating their comments, later a final questionnaire will be devised and take-in response from the respondents by using the questionnaire. The questionnaire might consist of three sections – questions regarding the background of the respondents, factors affecting improper safety management in Construction Industry and the current practice of Safety Management in Construction Project.

The aim of the data collection is to gather information regarding the safety management in construction project. The data collection will be conducted using Qualitative research and observation which is concerned with testing the theory presented with the objective. The data collections are basically done by questionnaire.

People are more truthful while responding to the questionnaires regarding controversial issues in particular due to the fact that their responses are anonymous. The questionnaire survey will be distributed to the construction project teams and it will be conducted online.

The objectives to form questionnaire is:

1. To identify the factors that affecting improper safety management in construction project.
2. To suggest some of the best practices in safety management for the construction industry.

To fill the questionnaire from staff, some instructions are given to avoid mistakes.

Along with the project detail, the questionnaire comprises of two parts factors affecting improper safety in construction project and current practices of safety in construction industry. Each point in questionnaire ranked from 1 to 5. 1-Strongly Disagree, 2-Disagree, 3–Moderately, 4-Agree 5-Strongly Agree.

The following questionnaire is prepare for factors affecting improper safety in construction project and data is collected

1. Organizational safety policy
2. Safety meeting
3. Safety training
4. Availability of safety equipment
5. Safety inspections
6. Safety incentives and penalties
7. Workers‟ attitude towards safety
8. Labour turnover rates
9. Compliance with safety legislation

The following questionnaire is prepare for current practices of safety in construction industry and data is collected

1. HSE policy is published to all worker
2. Safety Management System is established by the company
3. OSHA guideline is briefed to all employee
4. Safety awareness campaign is conducted by the company
5. Emergency response plan is used at the site
6. Safety tool box training is conducted daily
7. Scaffold is erected and dismantled under supervision of a designated person
8. The formwork braces and other supports is inspected by the designated person
9. All hoisting machinery such as mobile crane possessed certificate of fitness from the Department of Occupational Safety and Health.
10. The worker wear proper PPE at the construction site
11. Any accident is notified to the nearest Department of Safety And Health
12. Job safety/ hazard analysis is practiced at Construction site.
13. Safety signboards at workplace is put at the construction site
14. A safety and health officer is employed to ensure the safety of the site

V. DATA ANALYSIS

The data analysis will be done after the data collection is finished. All the data collected from the questionnaires will be analyzed and then summarized to obtain the appropriate and suitable result of the safety management in construction project. Data analysis is actually an approach to de-synthesize the data collected. It is a method of putting together facts and figures to solve problems and a systematic process of utilizing data to come up with the answer to the question.

The analysis of the survey is done by the Relative Importance Index (RII), Average Index Formula and Cronbach‟s Alpha (using SPSS Software) method. The scores were then transformed to importance indices based on the following formula.

a. Relative Importance/Difficulty Index

The data which is collected has been processed for carrying out analysis. The collect raw data of the questionnaire survey are entered into an Excel spreadsheet and SPSS (PASW) ver.18 program to analyze the data. The relative Importance Index (RII) is calculated to get the rank of the factors and the importance of safety in construction project.

Relative importance/difficulty index = $\Sigma w/AN$

Where w is the weighting given to each factor by the respondents, ranging from 1 to 5, A is the highest weight (i.e. 5 in the study) and N is the total number of samples.

b. Average Index Formula

The analysis was based on the qualitative measurement or ranking system. Rating for the questionnaire is 1 - Totally Disagree, 2 - Disagree, 3 - Moderately, 4 -Agree, 5 - Totally Agree.

The Average Index Formula (AI) = Σ(β X n) / N

Where, ß is weighing given to each factor by respondents

n is the frequency of the respondents

N is the total number of respondents

The rating scale based on average index calculated by above formula used in this project work is as shown below

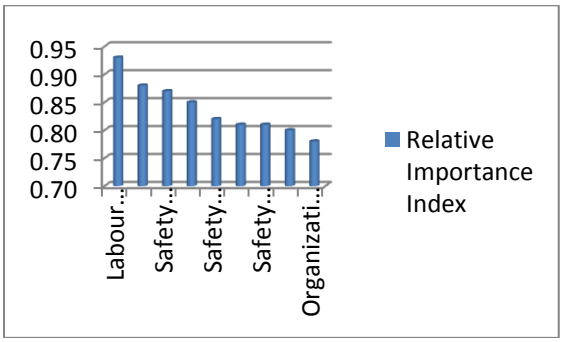
1 = Totally Disagree (from 1.00 to 1.50)
2 = Disagree (from 1.50 to 2.50)
3 = Neutral (from 2.50 to 3.50)
4 = Agree (from 3.50 to 4.50)
5 = Strongly Agree (from 4.50 to 5.00)

A. Factors Affecting Improper Safety Management Implementation in Construction Project.

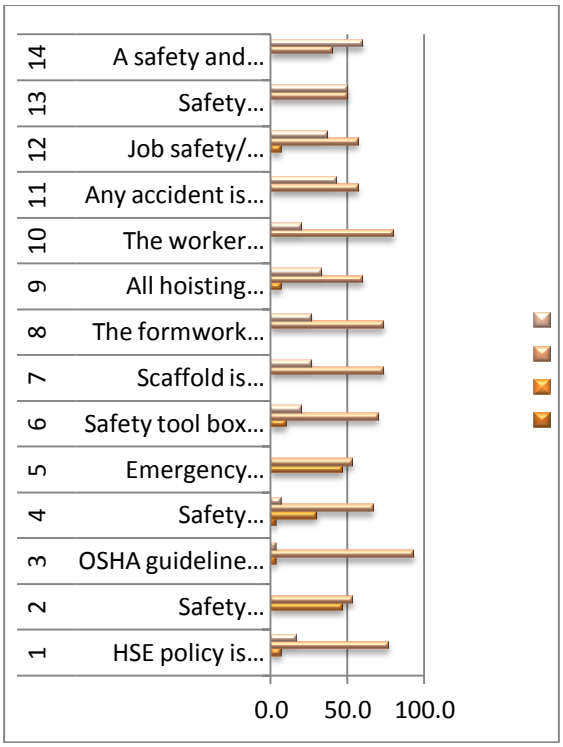
The collected data in the format of scores given to each factors affecting improper safety management implementation at construction site was analyzed by using relative importance formula for all the factors. The following table shows the result for the same.

No	Factor Affecting Improper Safety Management Implementation	Relative Importance Index (RII)
1	Organizational safety policy	0.78
2	Safety meeting	0.81
3	Safety training	0.81
4	Availability of safety equipment	0.80
5	Safety inspections	0.82
6	Safety incentives and penalties	0.87
7	Workers" attitude towards safety	0.85
8	Labour turnover rates	0.93
9	Compliance with safety legislation	0.88

Following is the chart showing Factors Affecting Improper Safety Management in Construction Site Vs Relative Importance Index



b. Current Practices of Safety Management at Construction Site



Based on the questionnaire, site visit performed and informal conversations with the engineer, the author have gathered several data. By comparing those findings, several conclusions can be made in order to comment about the currents practice of construction safety management at the project site. Firstly is the role of safety and health officer. Based on the survey, existence of safety officer is ranked as no 1. This shows that, the company employed safety and health officer for this project. On the other hand, based on the conversation with site engineer, the safety officer at the site has no competency in the safety. The ground level safety implementation somewhat poor due to cost and salary of paying the safety supervisor.

Secondly, there are contradiction of the findings in questionnaires and site visits. Based on the site visits, most of the labour didn't wear Proper Protective Equipment (PPE) at the construction site. For example, one of the workers didn't wear full body harness when concreting at the height above 6 feet. Based on site engineer of the company, the safety enforcement at the site is not stringent. The workers are allowed not to wear PPE at the construction site. One of the reasons why the workers are allowed is because if the management takes any action on the workers, the progress of the site will be decrease as most of the workers do not wear PPE.

Based on Chart 2, Safety awareness campaign are not agreed by 3.33 percent of the respondent. The items are (OSHA is practiced at construction site, the worker wear PPE at the site, HSE policy is published to all workers, OSHA guideline is briefed to all employees, safety awareness is conducted, emergency response plan is used at the site and Safety Management System is established by the company. The factor why they disagree is because probably the company did not really brief their policy of safety to their workers. Other than that, the workers themselves does not really concern and aware about the safety policy of the company. Due to this matter, the safety committee must take proper action in ensuring all of the workers know about the safety policy, current practice of the company and program conducted.

These findings may help the various stakeholders of a construction project to more effectively manage construction safety because those factors may facilitate making key decisions in a project. When safety aspects are well managed, the frequency of accident occurrences can be reduced. Additionally, this research provides effective and efficient guidelines on construction safety for construction organizations, and the framework has also been tested by collecting feedback from industry experts. The experts' opinions of the proposed safety assessment framework and its implications for industrial and academic development are included in the concluding remarks.

VI. CONCLUSION AND RECOMMENTATION

As per the overall study of safety policy in construction company chosen in this particular case study, that had good construction safety management.

1. The company is main contractor for this project, but yet they failed to follow all the rules and regulation of the authority like enforcing the worker to wear PPE at construction site. The same should be controlled by safety officers by regularly giving observation.
2. One of the factors that can conclude is that the company does moderately encounter any big safety issues like accident involving death and assets. Thus, they feel comfortable with the condition right now. This point should be improve as early as possible.
3. Another possible factors lead to this low safety awareness is due to high cost of paying for PPE, Safety and Health Officer Training and salary.
4. In terms of methodology, the questionnaire does not provide actual result as compared to direct observation. Beside the respondents wanted to finish answering the questionnaire quickly, they are not showing real responsibility towards their answer. This can be seen in the result of questionnaire whereby the result is not as similar in the site like wearing PPE at the construction site. Thus direct observation seems to have more reliable source. Besides that, small numbers of respondents have given inaccurate results based on how their answering the questioner caused by time constrain or pressure at work site.

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